

IV. NOTES ON ORDOVICIAN TRILOBITES. III.

ASAPHIDÆ FROM THE LOWVILLE AND BLACK RIVER.

BY PERCY E. RAYMOND AND J. E. NARRAWAY.

In a previous paper in these Annals we dealt with the *Illænidæ* collected by Mr. Narraway in the vicinity of Ottawa, Canada. The present paper is based largely on fossils collected by him in the same region, but the majority of the specimens figured are in the Carnegie Museum. The *Asaphidæ* of these formations are less numerous and diversified than the *Illænidæ*, and the specimens are not so well preserved. In the present paper *Bathyurus longispinus*, the hypostoma of *Bathyurus extans*, the free cheek of *Bathyurus spiniger*, and the cephalon of *Isoteloides homalnotoides* are figured for the first time. The cephalon, thorax, and hypostoma of *Basilicus romingeri* have not previously been figured or described, and a new species of Schmidt's genus *Onchometopus* is recognized. This latter genus has not previously been reported in this country.

To the list of trilobites published in our previous paper as occurring in the Black River at Ottawa should be added *Cyphaspis trentonensis* Weller and *Isoteloides homalnotoides* (Walcott). *Bathyurus extans* should be removed from the list, and *Asaphus romingeri* Walcott should read *Basilicus romingeri* (Walcott).

The drawings on the plates were made by Mr. Sydney Prentice, and the photographs are by Messers. A. S. and L. S. Coggeshall.

Family BATHYURIDÆ Miller

Genus BATHYURUS Billings.

Bathyurus extans (Hall).

Plate XV, figures 7, 8; Plate XVI, figure 5.

- Asaphus ? extans* HALL, Paleontology New York, I, 1847, 228, pl. 60, figs. 2a-2c;
Third Annual Report New York State Cabinet Natural History, 1850, 174,
pl. 3, figs. 1a-1c.
- Asaphus ? nodostriatus* HALL, Paleontology New York, I, 1847, 248, pl. 61, figs.
1a, 1b.
- Bathyurus extans* BILLINGS, Canadian Naturalist and Geologist, IV, 1859, 364;
Geology Canada, 1863, 153, fig. 114.—CLARKE, Paleontology Minnesota, III,
ii, 1897, 722, fig. 37.

This well-known species is very abundant in the buff dolomite of the Lowville at Mechanicsville, Pelton's quarry and other places near Ottawa. At some localities this is the only trilobite found in certain layers of the Lowville. In one layer at Mechanicsville where this is true, a few detached hypostomas have been found. Two of them are figured on the plates which accompany this article. In his original description of the genus Billings described the hypostoma as "oblong, not forked, somewhat oval, an elevated margin around the posterior two-thirds in some species, muscular impressions two, transverse or oblique, situated behind the middle." He did not give a figure, but in the "Paleozoic Fossils of Canada," Volume I, page 408, he states that the hypostoma is exactly like that of *Ogygia*. The hypostomas here figured are certainly similar to that of *Ogygia*, but they do not answer well to Billings' description. However, as *Bathyrus extans* is very abundant in the layer from which these specimens were obtained, and is the only trilobite present, it is believed that they belong to that species.

The glabella of this species is strongly convex, and is outlined by deep dorsal furrows and a very narrow concave anterior border. There are two pairs of shallow glabellar furrows, and in well preserved specimens the test shows a very few fine pustules scattered over the surface, as well as numerous, fine, wavy striæ. The neck-ring bears a low median pustule. The eyes are large and situated near the neck-ring. The free cheeks have narrow concave borders and the genal angles are drawn out into long spines.

The thorax has nine segments, is strongly convex, the axial lobe narrow, the pleura flat on top and sloping gently at the sides.

The pygidium is very convex, roughly triangular, and about three-fourths as long as wide. The axial lobe has two rings and a trace of a third on its anterior end. Otherwise it is smooth. The pleura slope rather abruptly to the narrow concave border, and show four pairs of broad segments, the fourth pair not well defined. On the first two pairs are slightly impressed lines.

This species does not seem to occur in the Black River, being replaced in that formation by *Bathyrus longispinus* and *B. spiniger*.

***Bathyrus longispinus* Walcott.**

Plate XVI, figures 12-14.

Bathyrus longispinus WALCOTT, Twenty-eighth Annual Report New York State Museum, 1879, 94.

?*Ptychopyge jerseyensis* WELLER, Paleontology New Jersey, III, 1902, 193, pl. 14, fig. 16.

Through the kindness of Curator Henshaw of the Museum of Comparative Zoology we are able to present figures of the fine fossil which is the type of this species. The species has not previously been figured and has therefore been confused with *Bathyrurus extans*. In *B. longispinus* the glabella is more pustulose, the brim¹ is wider and less concave, and the genal spines longer than in *B. extans*. The pygidia of the two species are quite different, that of *B. extans* being long and roughly triangular, while that of *B. longispinus* is nearly semicircular in outline, short and wide, and with a rather wide concave margin. The axial lobe of the pygidium is also shorter in this species than in *B. extans*, and has only two rings on the anterior end.

The cephalon of the type is 26 mm. long, measured along the axis to the back of the neck-ring, and 50 mm. to the tips of the spines. The pygidium is 13 mm. long and 25 mm. wide.

The fragment of a pygidium from the lower part of the Trenton of New Jersey which Weller described as *Ptychopyge jerseyensis* was very kindly loaned by Mr. Henry B. Kummel, State Geologist. It proves to belong to the genus *Bathyrurus*, and while hardly specifically identifiable, its short wide form and its geological position indicate that it is *B. longispinus*.

Locality.—This species is rather common in the Black River at Newport, New York, but has not been reported elsewhere, perhaps because it has been identified as *Bathyrurus extans*. It is not surely known to occur at Ottawa.

Bathyrurus spiniger (Hall).

Plate XV, figures 4-6.

Acidaspis spiniger HALL, Paleontology New York, I, 1847, 241, pl. 64, fig. 5.

Bathyrurus spiniger CLARKE, Paleontology of Minnesota, III, ii, 1897, 723, figs. 38-40. — RAYMOND, Bulletin American Paleontology, III, 1902, pl. 19, figs. 1-3.

In the Black River at Ottawa *Bathyrurus extans* is replaced by *Bathyrurus spiniger*, a species which ranges from the upper part of the Lowville to the middle of the Black River.

The glabella is very convex, covered with sharp tubercles, and the neck-ring bears a short stout spine which projects upward and backward. On young specimens there are two pairs of glabellar furrows whose direction is at almost right angles to the axis of the glabella. The furrows can be found on adults, but they are exceedingly faint. The eyes are large, the

¹This term is proposed by Bather for the flattened border on the cephalon of *Harpes*. (*Revista Italiana di Paleontologia*, 1910, 4.)

free cheeks rather small, the part below the eye being studded with sharp tubercles. The genal angles are produced into long spines.

The pygidium is shorter than that of *Bathyurus extans*, and the axial lobe even more prominent. There are four pairs of strongly marked ribs on the pleural lobes, all but the last pair showing an impressed median line. The axial lobe shows two distinct rings and from one to three indistinct ones, the smaller specimens showing the more rings. The first two rings bear median and lateral tubercles, and from the third and fourth rises a large spine which tapers rapidly and is curved backward. Back of this spine the axial lobe is nearly smooth, there being no strong rings, but there are usually a number of small tubercles arranged in rows parallel to the axis.

Family ASAPHIDÆ Emmerich.

Genus BASILICUS Salter.

Basilicus romingeri (Walcott).

Plate XV, figures 9-10; Plate XVI, figures 1-4.

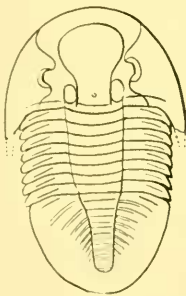
Asaphus romingeri WALCOTT, Twenty-eighth Annual Report New York State Museum, 1879, 96.

Asaphus wisconsensis WALCOTT, *ibidem*, 1879, 97.

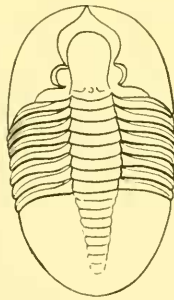
Ptychopyge romingeri CLARKE, Paleontology Minnesota, III, ii, 1897, 709.

Ptychopyge ulrichi CLARKE, *ibidem*, 1897, 709, figs. 12, 13.

This species is fairly common in the Black River at Ottawa, though no complete specimens have been found. The facial suture proves to be marginal in front, and therefore this species belongs to *Basilicus* and not to *Ptychopyge*.



1



2

FIG. 1. *Basilicus tyrannus* (Murchison). Outline drawing to show course of facial suture. After Salter.

FIG. 2. *Ptychopyge angustifrons* (Dalman). Outline drawing to show facial suture. After Brogger.

In 1905 Messrs. Douglass and Raymond collected a large number of cranidia and free cheeks of a *Basilicus* from the "buff" limestone about 20 feet above the top of the St. Peter sandstone on Straight River, two miles south of Faribault, Minnesota. Associated with these portions of head shields were a couple of fragmentary pygidia which appear to agree with the description of *Ptychopyge ulrichi* Clarke. Comparing these specimens with those from the Black River of New York and Canada, we are unable to find differences of specific value. *Ptychopyge ulrichi* was described from pygidia, the axial lobes of which bore eight or nine annulations, only three or four of which were well defined, and on the pleura were five pairs of ribs and a trace of a sixth, two or three more showing on the cast. This corresponds exactly with the specimens from New York and Canada.

Walcott states that *Asaphus wisconsensis* differs from *A. romingeri* "by having a wider and less concave margin, with the glabella more convex and subquadrate in front." These variations are noticeable on the specimens from Ottawa and those from Minnesota, but it is always the small specimens which have the wide margin and the more convex glabella, so that these are probably characters of immaturity. While we have not seen the types, we are inclined to believe that the two names represent the same species.

DESCRIPTION.

Specimens from Ottawa.—Cranidium convex, expanded in front of the eyes, concave around the anterior margin. Glabella prominent, definitely outlined, constricted between the eyes, marked by a pair of diagonal glabellar furrows between the eyes and obscure basal lobe back of the eyes. Neck-ring narrow and convex, neck-furrow shallow. Just in front of the furrow is a prominent median tubercle. From the front of the glabella a low ridge crosses the concave border and ends in a blunt point on the margin. Palpebral lobes large. The whole surface of the test is covered with fine irregular striations. In young specimens the concave border is proportionally broader, the anterior portion of the glabella more tumid, and the glabellar furrows more deeply impressed than in mature ones. The pygidia are nearly semicircular, with wide concave borders. Axial lobe prominent, showing about eleven rings on the cast of a young specimen and seven on a larger one. On the pleura are five or six pairs of prominent ribs.

Specimens from New York.—A single pygidium was collected by Mr.

Raymond from the Black River at the typical locality at Newport. This is larger than any of those found by Mr. Narraway at Ottawa, the rings are very faint on the axial lobe, and there are only four pairs of nearly flat ribs on the pleura.

In the collection at the Cornell University Museum there is a specimen labeled *Asaphus canadensis* from the "Bird-eye" at Poland, New York. This specimen, which is figured on Plate XV, fig. 10, is *Basilicus romingeri*, and a large part of the pygidium, seven segments of the thorax, the hypostoma, and a large, but incomplete free cheek are preserved. The pygidium, which is largely exfoliated, shows six fairly distinct rings on the axial lobe, with three or four faint ones behind them, and there are six pairs of broad, low ribs on the pleura. The axial lobe of the thorax is narrow, gently convex. The pleural lobes are broad, flat, gently curved at the sides. The pleura are broad, and have wide shallow furrows which begin at the edge of the axial lobe and extend diagonally backward and outward. Free cheek large, with broad concave margin and a wide genal spine. Hypostoma short and broad, forked, the posterior lobes short and wide, and the scars of muscular attachment strong. Its form is shorter and wider than that of *Isotelus*, and the body is definitely outlined from the wings. The test on all parts, including the hypostoma, is covered with irregular striæ.

Specimens from Minnesota.—The cranidia found in Minnesota do not differ in any way from those from Canada. A small specimen shows that the diagonal furrows between the eyes are distinct from those which isolate the basal lobes. The free cheeks have wide concave margins and broad genal spines. One of the two pygidia obtained is small and imperfect, but shows eight rings on the axial lobe and six pairs of ribs on the pleura. The large specimen is still more imperfect, but shows a wide concave margin and rather flat ribs.

Genus *ASAPHUS* Brongniart.

Subgenus *ONCHOMETOPUS* Schmidt.

Onchometopus simplex sp. nov.

Plate XVI, figures 6-8.

Associated with the preceding in Minnesota is a trilobite which may be referred to *Onchometopus*, as both the cephalon and pygidium lack the concave border seen on almost all our American asaphids, and at the same time have a smoother glabella and a wider axial lobe than *Asaphus*. *Basilicus romingeri*, *Isotelus gigas*, and a species of *Cybele* with a glabella

like that of *C. ella* Narraway and Raymond were found in the same stratum as the species here described.

DESCRIPTION.

Cranidium moderately convex, slightly incurved at the front. Glabella flat, obscurely defined, expanding in front of the eyes and extending to the anterior margin; glabellar furrows absent, dorsal furrows present back of the eyes, very shallow. Neck-furrow absent. Eyes of medium size, situated a trifle more than their own length in front of the posterior margin. Behind the eyes there is a small median tubercle on the glabella. Free cheeks rounded at the genal angles.

Thorax of eight flat segments. Axial lobe a little more than one-third the total width. Pleura with shallow grooves.

Pygidium rounded in outline, three-fifths as long as wide. Axial lobe obscurely defined, the posterior end usually a little more prominent than the other portions. There are no annulations. The surface is uniformly convex, without concave border.

This species is similar to *Onchometopus obtusus* (Hall) of the Chazy, but the shell lacks the very coarse punctæ of that form, and there are fewer traces of glabellar furrows. It differs from *Onchometopus susæ* (Whitfield) in having a longer pygidium with a narrower and more distinct axial lobe.

Onchometopus may be readily distinguished from *Isotelus* by the presence of a median tubercle on the glabella, the absence of a concave border on both cephalon and pygidium, and by the somewhat narrower axial lobe in the thorax.

Locality.—This species is quite abundant in the "buff" limestone, 20 feet above the top of the Saint Peter sandstone on Straight River, two miles south of Faribault, Minnesota. A single specimen was found in a quarry at Franklin Forge, Pennsylvania, and donated to the Carnegie Museum by Mr. Ernst W. Greiner.

Genus ISOTELOIDES Raymond.

Isoteloides homalnotoides (Walcott).

Plate XVI, figures 9-11.

Asaphus homalnotoides WALCOTT, Advanced Sheets Thirty-first Report New York State Museum, 1877, 20; Thirty-first Report New York State Museum, 1879, 71.—WHITFIELD, Geology of Wisconsin, IV, 1882, 237, pl. 5, fig. 4.

Asaphus triangulatus WHITFIELD, Annual Report Geological Survey of Wisconsin, 1880, 59.

A single cranidium belonging to this species has been found in the Black River at Ottawa. It is fairly common in the Black River at Pattersonville, New York, and in the lower part of the Trenton (zone with *Parastrophia hemiplicata*), at Smith's Basin. Both cephalae and pygidia are apt to be confused with *Isotelus gigas*, but the pygidia are more convex, more triangular, and have a narrow, prominent axial lobe. The glabella is obscurely outlined, there is a small median tubercle just in front of the neck-ring, and a pair of shallow, oblique glabellar furrows between the eyes. On the casts of the interior three pairs of glabellar furrows are faintly indicated. The axial lobe of the thorax is not so wide as in *Isotelus*, being about one-third the total width.

This species is referred to *Isoteloides* instead of *Isotelus* because of its faintly outlined glabella, the presence of glabellar furrows and a median pustule, and because of the narrow axial lobe. The hypostoma has not yet been seen.

This species is more closely allied to *Isoteloides angusticaudus* Raymond of the Chazy than to the type of the genus.

Genus ISÖTELUS Dekay.

Isotelus gigas Dekay.

Plate XV, figures 1, 2.

Isotelus gigas DEKAY, Annals Lyceum Natural History New York, I, 1824, 176, pl. 12, fig. 1.—HALL, Paleontology New York, I, 1847, 231, pls. 60-63.

No attempt is made to give the full synonymy of this species.

ONTOGENY.

The collections made by Mr. Narraway from the Black River near Ottawa contain a number of small and nearly complete specimens of this species which make it possible to observe with some completeness the later stages of growth.

The smallest specimen consists of a pygidium with four thoracic segments attached. The pygidium is three millimeters long and five wide, and the axial lobe of the thorax occupies exactly one-third the total width. The pygidium is nearly semicircular in outline, with a concave border. The axial lobe is very prominent and extends to this concave border. There are traces of six rings on the axial lobe, and three pairs of faintly outlined ribs on the pleura. Some pygidia a millimeter longer than this one show the segmentation more strongly than this particular specimen.

A pygidium from Trenton Falls has the same size and proportions as the one from the Black River just described.

The smallest specimen retaining the cephalon is slightly larger, as the pygidium is 3.5 mm. long. This specimen is, unfortunately, slightly imperfect, so that the length and breadth of the cephalon can not be accurately measured, but the cephalon appears to be about 1 mm. longer than the pygidium. The glabella is slightly convex, indistinctly outlined by dorsal furrows, and there are traces of three pairs of glabellar furrows and a neck-furrow. The furrows are not, however, much more strongly impressed than they are on some adults. In the middle of the neck-ring there is a slight swelling, suggesting a median tubercle. The eye which is preserved on this specimen is very large, being one-fourth the total length of the head, and situated slightly less than its own length from the posterior margin. Its actual position is, therefore, about the same as in the adult, but relatively it is a little further forward, its posterior margin being at a distance from the border of the cephalon equal to one-fourth the length of the head. An adult, with cephalon 50 mm. long, has eyes 7.5 mm. long, and they are situated 8 mm. from the posterior margin. Genal spines were present on this specimen, but are broken off. The smallest specimen retaining a complete genal spine has a cephalon about 8 mm. long, and the genal spine is 4.5 mm. long, and very narrow.

Twenty-one specimens of various sizes were measured, and it was found that with the increase in size, the width of the axial lobe of the thorax increased from one-third to one-half the total width, the maximum being reached on specimens with the pygidium 20 mm. long and a total length of about 57 mm. On all specimens larger than this the axial lobe occupied about one-half the width. The form of the pygidium was found to change from approximately semicircular in small specimens, to subtriangular in large ones. Thus, in the smallest specimens the length is .60 of the width, while in a specimen 55 mm. long, the length is .81 of the width. The change is a gradual one, but pygidia 11 mm. long have a distinctly triangular form, and the sides are straightened instead of being rounded as in the smaller specimens. Pygidia more than 50 mm. in length seem as a rule to be about three-fourths as long as wide, although exceptional specimens have been seen in which the length and breadth were equal. The subtriangular form of the pygidium is one of the most distinctive characters of this species. The axial lobe of the pygidium flattens out rapidly as the size increases. On pygidia 11 mm. long it is still distinct, but not bounded by sharp furrows as in the smallest speci-

mens, and there are almost no traces of rings or ribs. On pygidia 20 mm. long the axial lobe is very faint indeed.

The changes on the cephalon can not be so well observed for lack of good material. The outline becomes more triangular and the length and width change in the same way as in the pygidium. The eyes become relatively smaller and move backward, as already indicated, and the dorsal furrows become obscure. The spines at the genal angles become shorter, being 3 mm. long on a specimen with a cephalon about 20 mm. long, and being absent on specimens slightly larger.

Isotelus gigas is common in the Black River near Ottawa, but most of the specimens are small as compared with those found in the Trenton of New York. The species is less common in the Lowville, but typical pygidia have been found in that formation at Mechanicsville, near Ottawa, at Newport, and on Valcour Island, New York.

Pygidia less than 3 mm. long have not so far been seen by the writers, but on specimens of that length the segmentation is so faint that it seems improbable that a pygidium of this species 2 mm. long would be so strongly segmented as the pygidia described by Clarke as *Gerasaphes ulrichana*. (Paleontology Minnesota, Vol. III, pt. 2, p. 711, figs. 15, 16). Our studies do not, then, give any support to the suggestion of Miller that Clarke's specimens were the young of *Isotelus*. Strongly segmented pygidia of small size occur in the Chazy, but they have been found to belong to a species whose pygidia are strongly segmented when fully grown. Very small pygidia of *Isotelus*, some of them less than 3 mm. long, are common in the Chazy, but they show no more traces of segments than do the young of *Isotelus gigas*. The development of the species thus shows that the smooth surface was acquired earlier in the phylogeny than the broad axial lobe, and is thus a character of more profound importance.

Hall states (Paleontology New York, Vol. I, p. 231) that the pygidia of the young of *Isotelus gigas* are more pointed than in the adult, but our study shows a condition exactly opposite to this, the young pygidia being more rounded.

Isotelus maximus Locke is in many respects more primitive than *Isotelus gigas*. An incomplete specimen, a photograph of which is here presented, was about 95 mm. long, and has a genal spine 13 mm. long, which, when complete, reached at least as far back as the middle of the fourth segment. The specimen of *Isotelus gigas* represented as Figure 1 on Plate XV is 57 mm. long and the genal spine is only 3 mm. long. The pygidium of *Isotelus maximus* is short and rounded in outline like the young of *I. gigas*.

On the specimen here figured the length of the pygidium is only .64 of the width, and the axial lobe of the thorax is narrow for an *Isotelus*, being only .42 of the total width instead of .50 as in *I. gigas*.



FIG. 3. *Isotelus maximus* Locke. Photograph of a specimen in the Carnegie Museum, to show long genal spines and rounded pygidium.

***Isotelus* sp.**

Plate XV, figure 3.

Two specimens obtained by Mr. Narraway at Mechanicsville differ from the typical form of *Isotelus gigas* in having nearly semicircular pygidia, relatively narrower thoracic axes, and smaller eyes.

The larger specimen retains the cranidium, seven thoracic segments, and the pygidium. The cranidium is smooth, without glabellar furrows. The dorsal furrows are shallow and extend a little ahead of the eyes. Palpebral lobes small, a little further forward than in specimens of *Isotelus gigas* of this size.

Axial lobe of thorax more than one-third and less than one-half the total width, only slightly convex.

Pygidium evenly convex, rounded in outline, seven-tenths as long as wide. The margin has a wide concave border. The axial lobe is distinct but not prominent.

Length of cranidium, 30 mm.; width of thorax at back of fourth segment 44 mm.; width of axial lobe at same point, 19 mm.; length of pygidium, 32 mm.; width 45 mm. This specimen is from the Lowville at Mechanicsville.

The second specimen is slightly smaller and retains the posterior part of the cephalon with one eye, all the thorax and the pygidium. There are no spines at the genal angles, the eye is small and high, and the axial lobe of the pygidium is distinct and shows seven pairs of shallow pits on the anterior half.

The axial lobe of the thorax at the back of the fourth segment is 15 mm. wide, the total width being 35 mm.; the pygidium is 25 mm. long and 34 mm. wide. This specimen is from the Black River at Mechanicsville. Both specimens are in Mr. Narraway's collection.

These two specimens retain characters lost early in life by *Isotelus gigas*, namely, the narrow axial lobe of the thorax and the rounded pygidium. It is significant that they were found in the Lowville and Black River. A pygidium from the Lowville at Newport, New York, seems to belong to this species. Its dimensions are: length 31 mm., width 44 mm.; the length being .70 the width, as in the specimens from Mechanicsville. The pygidia of *Isotelus gigas* having this same ratio are from 10 to 20 mm. long.

EXPLANATION OF PLATES.

PLATE XV.

1. *Isotelus gigas* DeKay. A specimen from the Black River at Pattersonville, New York. This specimen shows the hypostoma in position, the subtriangular outline of cephalon and pygidium, and the small genal spine of an almost mature individual. About natural size. Specimen in the Carnegie Museum.

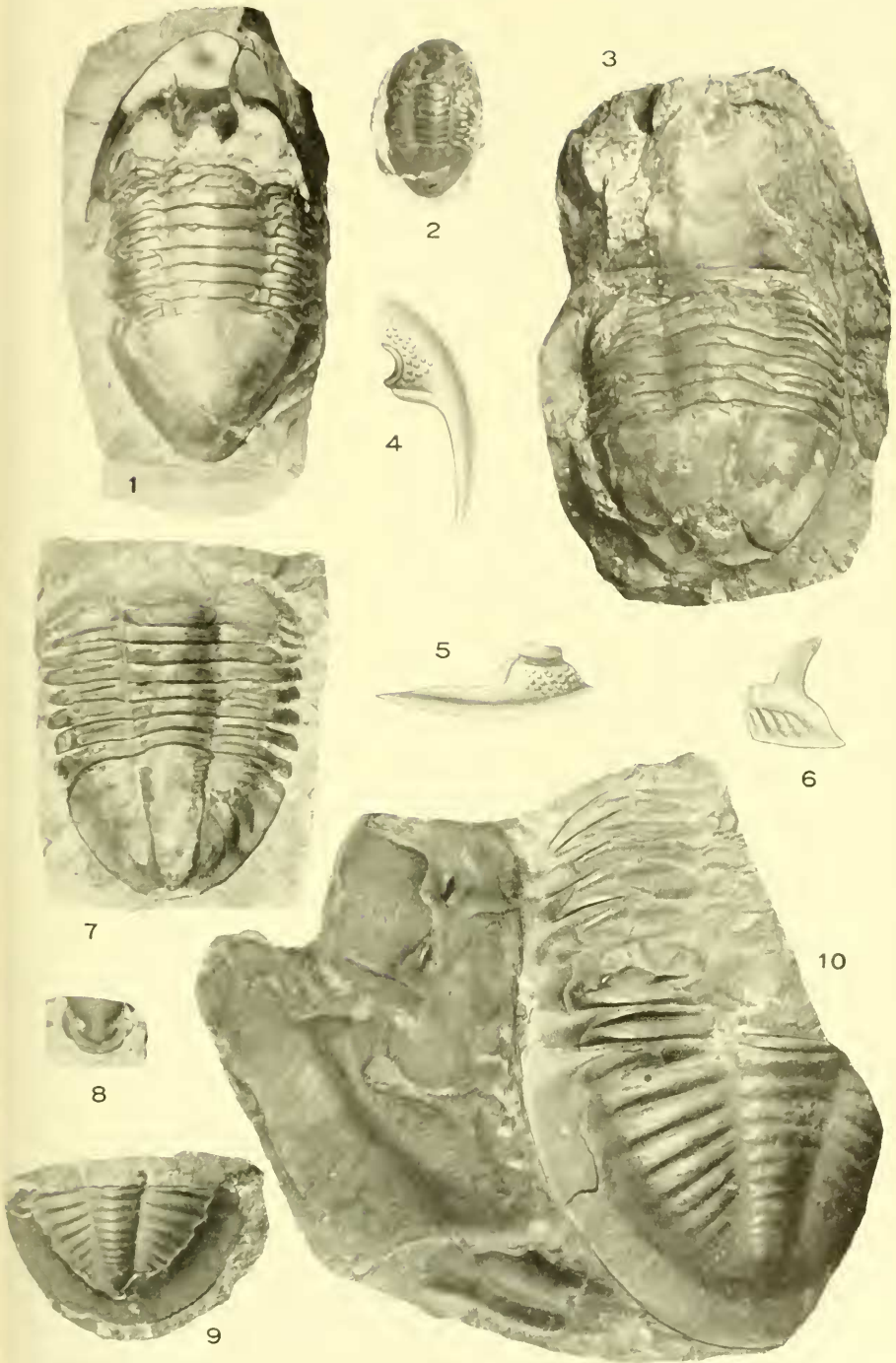
2. The same species. A small specimen from the Black River at Ottawa, Canada, in Mr. Narraway's collection. Three-fourths natural size.

3. *Isotelus gigas?* A specimen with a narrower axial lobe and a wider, shorter, and more rounded pygidium than is usually seen in *Isotelus gigas*. The specimen is from the Lowville limestone at Ottawa, and is in Mr. Narraway's collection. About natural size.

4. *Bathyurus spiniger* (Hall). Dorsal view of a free cheek from the Black River limestone at Mechanicsville, near Ottawa, Ontario. Nearly twice natural size. Specimen in the Carnegie Museum.
5. The same specimen; side view.
6. The same species. Side view of a well preserved pygidium from the same locality as the last. From Mr. Narraway's collection.
7. *Bathyurus extans* (Hall). A large specimen in the Carnegie Museum from the Lowville at Black River, New York. About natural size.
8. The same species. An hypostoma from the Lowville at Mechanicsville, Ontario. About natural size. In Mr. Narraway's collection. Collected by Mr. J. S. Hale.
9. *Basilicus romingeri* (Walcott). A small pygidium from the Black River at Mechanicsville. The specimen is in Mr. Narraway's collection, and the figure is about natural size.
10. The same species. A specimen from the Black River at Poland, New York. This specimen shows parts of seven segments of the thorax, the hypostoma, and parts of the free cheek and pygidium. It is in the Museum of Cornell University, and the figure is about natural size.

PLATE XVI.

1. *Basilicus romingeri* (Walcott). An incomplete free cheek from Faribault, Minn., now in the Carnegie Museum. The shell is exfoliated from the portion in front of the eye, and the anterior limb of the facial suture shows as a line on the inner surface of the doublure. Natural size.
2. The same species. A cranium from the Black River at Mechanicsville, Ontario. Twice natural size. In the collection of the Carnegie Museum.
3. The same species. A cranium from Faribault, Minnesota. Specimen in the Carnegie Museum. Natural size.
4. The same species. A small specimen from Faribault, Minnesota. This specimen shows a low axial ridge in front of the glabella such as is seen in specimens of *Basilicus marginalis* of all sizes. Twice natural size.
5. *Bathyurus extans* (Hall). A hypostoma from the Lowville limestone at Mechanicsville, Ontario. Twice natural size. Specimen in the Carnegie Museum.
6. *Onchometopus simplex* Raymond and Narraway. An imperfect cranium from Faribault, Minnesota. Natural size. Specimen in the Carnegie Museum.
7. The same species. A pygidium from the same locality as the last. Natural size.
8. The same species. An incomplete specimen in the Carnegie Museum from Franklin Forge, Pennsylvania. Natural size.
9. *Isoteloides homalnotoides* (Walcott). A pygidium from the Black River limestone at Pattersonville, New York. A little less than natural size. Specimen in the Carnegie Museum.
10. The same species. A cephalon drawn from a nearly complete specimen from the same locality as the last.
11. The same species. An exfoliated cranium from the lower part of the Trenton at Smith's Basin, New York. Notice the small eyes and the two shallow pits which are vestiges of glabellar furrows. Natural size. Specimen in the Carnegie Museum.



Louis S. Coggeshall, photo.

Black River Trilobites.